

Simplify Products or Quotients of Single Variable Expressions

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CONCEPT

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Simplify Products or Quotients of Single Variable Expressions

Here you'll learn to simplify products or quotients of single variable expressions.

Have you ever had a stamp collection?

Marc has twice as many stamps in his collection as his Grandfather has in his. Write an expression to represent m , the number of stamps in his Grandfather's collection.

To solve this problem, you will need to know how to write a single variable expression. Pay attention to this Concept, and you will know how to do this by the end of the Concept.

Guidance

Previously we learned that when you add and subtract terms in an expression, you can only combine like terms.

However, you can multiply or divide terms whether they are like terms or not.

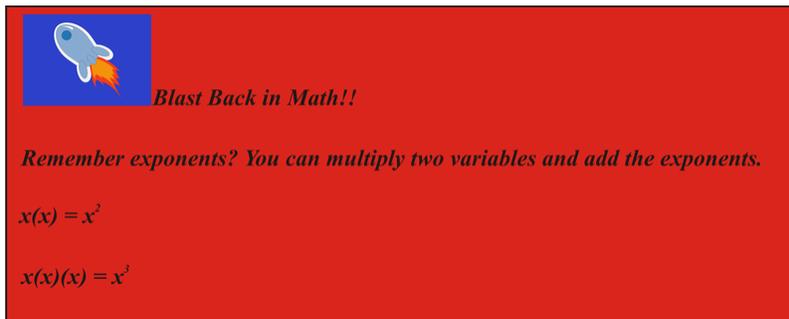
For example, $6a$ and $3a$ are like terms because both terms include the variable a . We can multiply them to simplify an expression like this.

$$6a \times 3a = 18 \times a \times a = 18a^2.$$

However, even though $6a$ and 3 are *not* like terms, we can still multiply them, like this.

$$6a \times 3 = 18a.$$

The Commutative and Associative Properties of Multiplication may help you understand how to multiply expressions with variables. Remember, the *Commutative property* states that factors can be multiplied in any order. The *Associative property* states that the grouping of factors does not matter.



Blast Back in Math!!

Remember exponents? You can multiply two variables and add the exponents.

$$x(x) = x^2$$
$$x(x)(x) = x^3$$

Let's apply this information.

$$6a(3a)$$

We can take these two terms and multiply them together.

First, we multiply the number parts.

$$6 \times 3 = 18$$

Next, we multiply the variables.

$$a \cdot a = a^2$$

Our answer is $18a^2$.

Here is another one.

$$5x(8y)$$

Even though these two terms are different, we can still multiply them together.

First, we multiply the number parts.

$$5 \times 8 = 40$$

Next, we multiply the variables.

$$x \cdot y = xy$$

Our answer is $40xy$.

Find the product $4z \times \frac{1}{2}$.

$4z$ and $\frac{1}{2}$ are not like terms, however, you can multiply terms even if they are not like terms.

Use the commutative and associative properties to rearrange the factors to make it easier to see how they can be multiplied.

According to the commutative property, the order of the factors does not matter.

$$\text{So, } 4z \times \frac{1}{2} = \frac{1}{2} \times 4z.$$

According to the associative property, the grouping of the factors does not matter. Group the factors so that the numbers are multiplied first.

$$\text{So, } \frac{1}{2} \times 4z = \frac{1}{2} \times 4 \times z = \left(\frac{1}{2} \times 4\right) \times z.$$

Now, multiply.

$$\left(\frac{1}{2} \times 4\right) \times z = \left(\frac{1}{2} \times \frac{4}{1}\right) \times z = \frac{4}{2} \times z = 2 \times z = 2z.$$

The product is $2z$.



Remember that the word **PRODUCT** means multiplication and the word **QUOTIENT** means division.

Here is one that uses division.

Find the quotient $42c \div 7$.

It may help you to rewrite the problem like this $\frac{42c}{7}$. Then separate out the numbers and variables like this.

$$\frac{42c}{7} = \frac{42 \cdot c}{7} = \frac{42}{7} \cdot c$$

Now, divide 42 by 7 to find the quotient.

$$\frac{42}{7} \cdot c = 6 \cdot c = 6c$$

The quotient is $6c$.

Now it's your turn. Find each product or quotient.

Example A

$$6a(9a)$$

Solution: $54a^2$

Example B

$$\frac{15b}{5b}$$

Solution: 3

Example C

$$\frac{20c}{4}$$

Solution: $5c$

Here is the original problem once again.

Marc has twice as many stamps in his collection as his Grandfather has in his. Write an expression to represent m , the number of stamps in his Grandfather's collection.

To write this, we simply use the variable and the fact that Marc has twice as many stamps.

$$2m$$

This term represents Marc's stamps.

Vocabulary

Expression

a number sentence without an equal sign that combines numbers, variables and operations.

Simplify

to make smaller by combining like terms.

Product

the answer in a multiplication problem.

Quotient

the answer in a division problem.

Commutative Property of Multiplication

states that the product is not affected by the order in which you multiply factors.

Associative Property of Multiplication

states that the product is not affected by the groupings of the numbers when multiplying.

Guided Practice

Here is one for you to try on your own.

Find the quotient $50g \div 10g$.

Answer

It may help you to rewrite the problem like this $\frac{50g}{10g}$. Then separate out the numbers and variables like this.

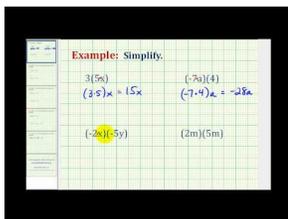
$$\frac{50g}{10g} = \frac{50 \cdot g}{10 \cdot g} = \frac{50}{10} \cdot \frac{g}{g}$$

Now, divide 50 by 10 and divide g by g to find the quotient. Since any number over itself is equal to 1, you know that $\frac{g}{g} = 1$.

$$\frac{50}{10} \cdot \frac{g}{g} = 5 \cdot 1 = 5$$

The quotient is 5.

Video Review



MEDIA

Click image to the left for more content.

- This is a James Sousa video on combining like terms by multiplying.

Practice

Directions: Simplify each product or quotient.

1. $6a(4a)$

2. $9x(2)$

3. $14y(2y)$

4. $16a(a)$

5. $22x(2x)$

6. $18b(2)$

7. $\frac{21a}{7}$

8. $\frac{22b}{2b}$

9. $\frac{25x}{x}$

10. $\frac{45a}{5a}$

11. $\frac{15x}{3x}$

12. $\frac{18y}{9}$

13. $\frac{22y}{11y}$

14. $\frac{15x}{3y}$

15. $\frac{82x}{2x}$